Meridian 1

Intelligent peripheral equipment circuit cards for Italy

Option 11 - Description and Installation

Document Number: Supplement to 553-3011-210
Document Release: Provisional 1.0
Date: April 1994

© 1994
All rights reserved

Printed in Canada

Information is subject to change without notice. Northern Telecom reserves the right to make changes in design or components as progress in engineering and manufacturing may warrant. This equipment has been tested and found to comply with the limits for a Class A digital device pursuant to Part 15 of the FCC rules.

SL-1 and Meridian 1 are trademarks of Northern Telecom.

Revision history

August 15, 1993

Version 1.0…

Contents

About this document vii

General Specification 1

Central office trunk circuit card 7

Functional description 7

Physical description 8

Technical description 12

Trunk types description 15

E&M tie trunk circuit card 19

Functional description 19

Physical description 20

Technical description 29

Trunk types description 32

Direct Inward Dial / TIE trunk card 41

Functional description 41

Physical description 42

Technical description 45

Direct Inward Dial description 48

Loop Dial Repeating Tie Trunk 50

NT5K02JA Flexible analog line circuit card 55

Functional description 55

Physical description 56
Technical description 56

Tone detector circuit card 59

. 59
Physical description 60
Technical description 60
Country specific tone detection 62

About this document

This document is a Supplement to the Option 11 *Installation guide* (553-3011-210). It describes the functions and applications of the following circuit cards that are available for use in Italy.

- NTCK18AA Central Office Trunk card
- NT5K83GA E&M Tie Trunk card
- NTCK22AA Direct Inward Dial / TIE trunk card.
- NT5K02TA Flexible Analog Line card with message waiting
- NT5K96TA Flexible Analog Line card without message waiting
- NT5K48 Tone Detector

General Specification

Introduction

This document is a Supplement to the Option 11 *Installation guide* (553-3011-210). It describes the functions and applications of the circuit cards that are available for use in Italy.

Hardware Release

Table 1 provides the circuit card information for the Option 11 system.

Table 1
Circuit card release

Unit	Code	Description
XFCOT	NTCK18AA	8 Port CO trunk with PPM and busy tone detect.
XDID	NTCK22AA	8 Port Direct Inward Dial/Loop Dial Repeat trunk
XFALC	NT5K02TA	16 port analogue line card/Low voltage message waiting
XFALC	NT5K96TA	16 port analogue line card
XFEM	NT5K83GA	4 Port 4W/2W E&M, RAN, Paging, Music
XTD	NT5K48AA	8 Port Tone (DTMF/Dial tone) detector
M2250	NT6G57AA	Italian Digital Attendant Console

Italian Transmission Plan

The network configurations require that circuit packs being introduced support both the New and Old Loss Plan. The classification for the Option 11 peripheral packs is shown in Table 2 for the New loss plan and in Table 3 for the Old loss plan.

Table 2
New loss plan

Port type	Pack	Sigl type	Loss D/A	Loss A/D	CLS
B	XFCOT	COT	+1	-6	LOL
B	XDID/TIE	DID	+1	-6	LOL
B (note 1)	XDID/TIE	LDR	+1	-6	NTC
C (note 1)	XDID/TIE	LDR	+7	0	TRC
B	XFEM	2W E&M	+1	-6	NTC
C	XFEM	2W E&M	+7	0	TRC
D	XFEM	4W E&M	+3.5	-3.5	NTC
C1	XFALC		+7	0	
N/A	XFEM	RAN	+3.5	N/A	N/A
N/A	XFEM	PAG	N/A	-3.5	N/A
N/A	XFEM	MUS	N/A	-3.5	N/A

The four types of ports are described as follows:

- Type D interface: This defines a set of transmission characteristics for a 4W trunk connection. This definition is applied to a 4W tie trunk connection.
- Type B interface: This is a 2W trunk connection. This Port classification applies to all CO trunk connections (i.e. COT and DID) . This classification can also be applied to a 2W tie trunk connection.
- Type C1 interface: This defines the Transmission characteristics of a line card connection.
- Type C Interface: This is a 2W tie trunk connection which has the same characteristics as a line card connection.

Note 1: LDR siginalling is supported from release 20 software onward.

Table 3
Old loss plan

Port type	Pack	Pads	Loss D/A	Loss A/D	CLS
XFCOT	COT	out	-3	0	LOL
		in	+1	+4	
XDID/TIE	DID	out	-3	0	SHL
		in	-1	+2	
XDID/TIE	LDR	out	-3	0	NTC
		in	-1	+2	
XFEM	2W E&M	out	-3	0	NTC
		in	-1	+2	
XFEM	4W E&M	out	-3	0	NTC
		in	-1	+2	
XFALC		N/A	+1	+4	N/A
XFEM	RAN	in/out	+3.5	N/A	N/A
XFEM	PAG	in/out	N/A	-3.5	N/A
XFEM	MUS	in/out	N/A	-3.5	N/A

Tone Detection, New Loss Plan

DTMF detection

In Overlay 97 configure;

- MINL = 30

Dial tone detection

In Overlay 97 configure the following;

- DFQ = 4
  MDL = -28
  MVT = 600
  BRK = 00
  CAD = 00

Tone and Cadence for New Loss Plan

DTMF Tones

Configure DTMF tone levels in Overlay 97, (XCTP, DTMF=191). This corresponds to a level of -9/-7 dB below overload. The tones are A-law.

Call Progress Tones

Configure the tones and cadences in Overlay 56 as shown in Table 4.

Table 4
Controlled Tones

Tone	Freq	XTON	Level	Cadence
Dialtone	350/420	212	-9/-9	Continuous
Special dialtone	420	109	-9	0.1 on,0.1 off,0.1 on,0.1 off,0.1 on,1.5 off, repeat
Ringback	420	109	-9	1 Sec on, 4 Sec off, repeat
Busytone	420	109	-9	0.5 Sec on, 0.5 Sec off, repeat
Overflow	420	109	-9	0.1 Sec on, 0.1 Sec off, repeat
Confirmation	420	109	-9	0.1 on,0.1 off,0.1 on,0.1 off,0.1 on,1.5 off, repeat
Intrusion	420	213	-14	0.2 on, 0.2 off, 0.2 on,1.4 off, repeat
Override	420	213	-14	0.2 on, 0.2 off, 0.2 on,1.4 off, repeat
Camp-on	420	213	-14	0.2 on, 0.2 off, 0.2 on,3.4 off, repeat
Call Waiting	420	213	-14	0.1 Sec on, 4.9 Sec off, repeat
Conference Warning	420	213	-14	0.2 Sec on, 9.8 Sec off, repeat (Note 1)

Note 1: This tone is software controlled.

Digipulse dialing

Configure approximately 60/40 break/make ratio in Overlay 97, (SYSP, P10R = 58)

Tones and Cadences for Old Loss Plan

DTMF Tones

Configure DTMF tone levels in overlay 97 (XCTP, DTMF =218). This corresponds to a level of -14/-12 dB below overload. The tones are A-Law.

Call Progress Tones

Configure the tones and cadences in Overlay 56 as shown in Table 5.

Table 5
Controlled Tones

Tone	Freq	XTON	Level	Cadence
Dialtone	350/420	217	-14	Continuous
Special dialtone	420	213	-14	0.1 on,0.1 off,0.1 on,0.1 off,0.1 on,1.5 off, repeat
Ringback	420	213	-14	1 Sec on, 4 Sec off, repeat
Busytone	420	213	-14	0.5 Sec on, 0.5 Sec off, repeat
Overflow	420	213	-14	0.1 Sec on, 0.1 Sec off, repeat
Confirmation	420	213	-14	0.1 on,0.1 off,0.1 on,0.1 off,0.1 on,1.5 off, repeat
Intrusion	420	163	-22	0.2 on, 0.2 off, 0.2 on,1.4 off, repeat
Override	420	163	-22	0.2 on, 0.2 off, 0.2 on,1.4 off, repeat
Camp-on	420	163	-22	0.2 on, 0.2 off, 0.2 on,3.4 off, repeat
Call Waiting	420	163	-22	0.1 Sec on, 4.9 Sec off, repeat
Conference Warning	420	163	-224	0.2 Sec on, 9.8 Sec off, repeat (Note 1)

Note 1: This tone is software controlled.

Digipulse dialing

Configure approximately 60/40 break/make ratio in Overlay 97, (SYSP, P10R = 58)

M2250 and Aries sets

For the New Loss plan, use the following configuration in overlay 17.

- CODE = 2 (A-law)
  TOLR = 63
  ROLR = 2
  SOLR = 3
  HTLR = 52
  HRLR = 8
  AGCD = YES
  VOLR = YES

For the Old Loss plan, use the following configuration in overlay 17. :

- CODE = 2 (A-law) or 0 (u-Law) as required
  TOLR = 52
  ROLR = 36
  SOLR = 3
  HTLR = 52
  HRLR = 8
  AGCD = YES
  VOLR = YES

Central office trunk circuit card

Functional description

The NTCK18AA Central Office trunk card provides the interface between the Option 11 system and up to eight analog central office (CO) trunks. It can be installed in slots 1-10 in the main cabinet and in any slot in the expansion cabinet.

Common features

The NTCK18AA Central office trunk card:

- is equipped with eight trunk units
- supports internal 12 kHz periodic pulse metering (PPM)
- allows trunk type to be configured on a per unit basis
- allows individual units or the entire board to be disabled by software
- provides software selectable A-law or μ-law companding
- indicates self-test status during an automatic or manual self-test
- provides debounce / counting feature for 12Khz PPM
- converts transmission signals from analog-to-digital and from digital-to-analog
- supports the new Italian loss plan
- provides adjustable transmission pads for long or short line operation

- provides termination and transhybrid balance impedance to match the Italian complex impedance network
- provides direct reporting of Periodic Pulse Metering (PPM) pulses to software in either buffered or unbuffered format.
- provides a software selectable loss plan which allows a choice of either the old or new Italian loss plan
- supports loop start signaling
- provides busy tone detection on a per unit basis.

Physical description

Switch settings

There are no option switches on the NTCK18AA Central office trunk card. All settings are configured in software.

Connections

The NTCK18AA Central office trunk card has eight units. Each unit connects to the shelf backplane through an 80-pin connector. The backplane is cabled to the input/output (I/O) panel which is then cabled to the cross-connect terminal.

Hardware installation

Table 1 provides cross connect information for the NTCK18AA Central Office Trunk card.

Table 6
NTCK18AA Central Office Trunk connections

Lead	Pins	Pair color	Unit number
T0 R0	26 1	W-BL BL-W	Unit 0
	27 2	W-O O-W	
T1 R1	28 3	W-G G-W	Unit 1
	29 4	W-BR BR-W	
T2 R2	30 5	W-S S-W	Unit 2
	31 6	R-BL BL-R	
T3 R3	32 7	R-O O-R	Unit 3
	33 8	R-G G-R	
T4 R4	34 9	R-BR BR-R	Unit 4
	35 10	R-S S-R	
T5 R5	36 11	BK-BL BL-BK	Unit 5
	37 12	BK-O O-BK	
T6 R6	38 13	BK-G G-BK	Unit 6
	39 14	BK-BR BR-BK	
T7 R7	40 15	BK-S S-BK	Unit 7
	41 16	Y-BL BL-Y	

Trunk configuration

Route Data Block

Each trunk unit on the NTCK18AA central office trunk card is attached to a route with an associated route data block. Periodic Pulse Metering (PPM) and trunk timers are configured on a route basis. The route data block is programmed in overlay 16. All prompts are defaulted except for those noted in Table 2. Default values are shown in brackets.

Table 7
LD 16 Route Data Block

Prompt	Response	Comments
REQ	NEW	
TYPE	RDB	Define a new Route Data Block
CUST	0-99	Enter customer number
ROUT	0-511	Enter route number
TKTP	COT	Define trunk type as Central Office
ICOG	IAO	Incoming and Outgoing trunk
CNTL	YES	Change a trunk timer
TIMER	RGV 128	Set Ring Validation Timer to 128 ms
see note	GTO 1920	Set Guard Timer Outgoing to 1920ms
CDR	YES	Call Detail Recording allowed
MR	(NO), PPM, XLD	PPM is off, buffered or unbuffered on this route

Note: Only necessary to set GTO=1920 if PPM configured. There is a 1.7 second delay in disconnection of PPM detector at the end of call.

Trunk Data Block

Use overlay 14 to configure each of the trunk units on the NTCK18AA central office trunk. Default values are shown in brackets.

Table 8
LD 14 Trunk Data Block

Prompt	Response	Comments
REQ	NEW	Define a new trunk unit
TYPE	COT	Central Office Trunk
TN	CC UU	Terminal number of the unit in Option 11 format: CC=card number UU=unit number
XTRK see note 1	XCOT	Type is IPE COT
CDEN	(8D)	Card density is 8D (default)
SIGL	LOP	Loop start signaling
PPID see note 1	04	Italian PPM ID
BTID see note 1 & 2	12 13	Italian Busy Tone ID
BIMP	(600), 3COM	Balance impedance selection
SEIZ	YES, (NO)	Automatic guard detection for outgoing trunk
CLS	SHL, (LOL)	Attenuation Pads In, (Out)
	BTS, (XBTD)	Busy tone supervision enabled, (disabled)
	DTN, (DIP)	Digitone signaling, (digipulse)

Note 1: These prompts are required only for the first unit defined on each NTCK18AA card.

Note 2: BTID = 12, corresponds to busy tone cadence of 200 ms on / 200 ms off.
BTID = 13 corresponds to busy tone cadence of 500ms on / 500ms off.

Self-test

When the NTCK18AA trunk card is installed and power is applied to it, a self-test is performed on the card. The red LED on the faceplate flashes three times, then remains continuously lit until the card is enabled in software. If the self-test fails, the LED will remain lit.

Technical description

Power requirements

Table 4 shows the power requirements for the NTCK18AA Central office trunk card.

Table 9
NTCK18AA circuit card power requirements

Voltage	Idle current	Active current
+15.0 V dc (see note 1)	170 ma	252 ma
-15.0V dc (see note 1)	170 ma	249 ma
+ 8.5 V dc (see note 2)	80 ma	100 ma
+ 5.0 V dc	200 ma	322 ma

Note 1: Analog circuitry is powered with +/- 12V generated from +/- 15V. The maximum current imbalance between the +/- 15V rails is 100 ma per circuit pack.

Note 2: 8.5V is regulated to give 5V.

Environmental specifications

Table 5 lists the environmental specifications of the NTCK18AA Central office trunk card.

Table 10
NTCK18AA circuit card environmental specifications

Parameter	Specifications
Operating temperature	0 to 40 degrees C
Operating humidity	10 to 95 % Relative Humidity
Storage temperature	- 45 to + 70 degrees C
Storage humidity	0 to 95 % Relative Humidity

Transmission parameters

The NTCK18AA Central Office trunk card supports the old and new Italian loss plan. Both these loss plans are configured in overlay 97. The new Italian loss plan will use the Static Loss plan download and the old loss plan will use the Dynamic Loss Switching feature.

New Loss Plan

For compliance with the new loss plan the Central Office trunk must be configured with the characteristics of a type B interface. The settings for basic configuration are as follows;

- Overlay 97
  Enable the Static Loss download feature.
  - Select A-law encoding INTN = YES.
  - Select Static Loss base table TNUM = 9.
- Overlay 14
  Configure the port CLS as LOL.
  - Select BIMP = 3COM for a complex balance impedance.
- Overlay 56
  Set TBAR so that all B type ports are barred access from each other (type B - B ports may have stability problems from high gain).

The new loss plan for the NTCK18AA Central office trunk card is given in Table 6. This is a static loss plan which means that the A/D and D/A losses are downloaded when the trunk is enabled. The losses do not vary on a per-call basis.

Table 11
NTCK18AA Type B Loss Settings

New loss plan	Long Line(LOL)	Short Line(SHL)
Analog-to-Digital loss	–6.0 dB	–6.0 dB
Digital-to-Analog loss	+1.0 dB	+1.0dB

Note: The tolerance for the above nominal values is ±0.5 dB.

Old Loss Plan

The old loss plan for the NTCK18AA trunk card is given in Table 7. This is a dynamic loss plan which means that the A/D and D/A losses are downloaded to the trunk on a per call basis. Pads are switched in or out on the trunk depending on the terminating port type. The settings for basic configuration are as follows;

- Overlay 97
  Enable the Static Loss download feature.
  - — Select A-law encoding INTN = YES.
  - — Select Static Loss base table TNUM = 10.
  - — Select Dynamic Loss alternative table TNUM = 3
- Overlay 14
  Configure the port CLS as LOL.
  - — Select BIMP = 600 for balance impedance.
- Overlay 15
  Set APAD = 3. This selects a unique Italian Loss switching matrix.

Table 12
NTCK18AA Pad Switching/Old Loss Plan

Old loss plan	Long Line(LOL) Pads out	Short Line(SHL) Pads in
Analog-to-Digital loss	0.0 dB	+4.0 dB
Digital-to-Analog loss	-3.0 dB	+1.0dB

Note: The tolerance for the above nominal values is ±0.5 dB.

Trunk types description

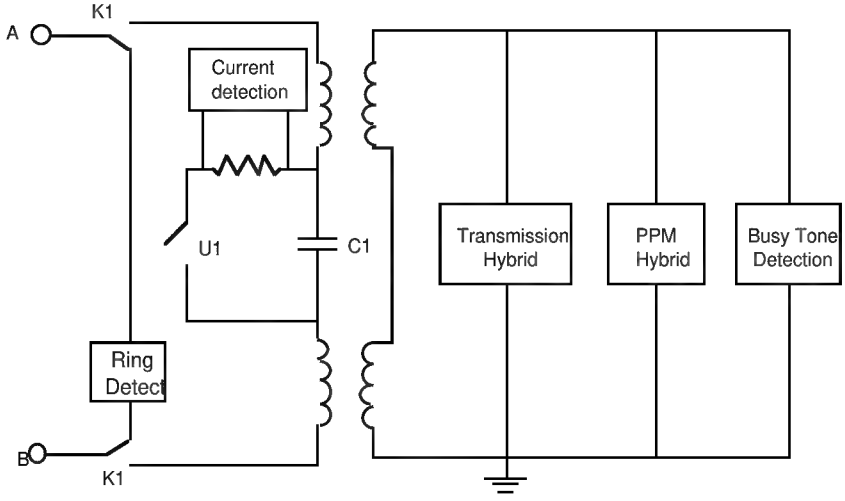
Each NTCK18AA Central office trunk card supports:

- Loop start operation
- Busy tone detection and supervision

Loop start operation

Loop start operation is configured in software and is implemented in the card through software download messages.

Figure 1
NTCK18AA loop start operation



Idle state

In the idle state the ringing detector is connected across the A and B wires through the normally closed contacts of relay K1. The XFCOT presents a high impedance to the Central Office.

Far end originated

The Central Office initiates a call by applying ringing between the A and B wires. Ringing signals that fall within the limits will be detected within 200ms of application. If the call is answered, a seize message is sent to the trunk card from software. Relay K1 switches out the ringing detector and presents a low impedance loop across the A and B wires.

Near end Originated

The Option 11 originate a call by activating K1 and U1, which switches out the ringing detector and presents a low impedance loop across the A and B wires. Address information is sent to the Central Office in the form of pulse digits or Dual Tone Multifrequency (DTMF) signals.

Seizure acknowledge

This feature is configured on a unit basis and is called Autoguard. It will prevent the loop-start trunk from being seized for outgoing traffic if loop current is not detected. Normally software will receive a seizure acknowledge message, if not, then a software timer will hold the unit busy and another trunk in the route data block will be seized. The XFCOT will still accept incoming calls.

Far end release

If Busy Tone detection is configured, then on receipt of a busy tone signal from the far end the XFCOT will send a disconnect message to software. The software will distinguish between near end and far end busy tone.

Near end release

The Option 11 disconnects the call by opening relays U1 and K1, re-inserting the ringing detector across the A and B wires. If the trunk is configured for PPM detection there will be a delay between K1 and U1. The low impedance path remains for 1.7 seconds for PPM detection, then relay K1 times out, breaking the DC loop and re-connecting the ringing detector. If an incoming call is released, or if PPM is not configured then U1 and K1 will switch simultaneously.

Periodic Pulse Metering (PPM)

All trunk units on the NTCK18AA card can be individually configured to support the Periodic Pulse Metering (PPM) feature.

Periodic Pulse Metering allows the user of a telephone on a Option 11 to keep an accurate record of central office calls for billing or administration purposes pertaining to Central Office and Direct Dialing calls.

For more information on PPM, refer to *Generic X11 Including Supplementary Features appendix 2 to 553-2311-105.*

E&M tie trunk circuit card

Functional description

The NT5K83GA E&M Tie trunk card provides the interface between the Option 11 system and up to four analog trunks. It can be installed in slots 1-10 in the main cabinet and in any slot in the expansion cabinet.

- The NT5K83GA E&M Tie trunk card supports four analog trunks. Each trunk circuit can be individually configured as:
- 4-wire E&M Type 1, 2 and type 5(BPO)
- 2-wire E&M Type 1, 2 and type 5(BPO)
- Recorded Announcement trunk (RAN)
- Music trunk (MUS)
- Paging trunk (PAG)

Common features

The NT5K83GA E&M Tie trunk card:

- is equipped with four trunk units
- converts transmission signals from analog-to-digital and from digital-to-analog
- provides software selectable A-law or μ-law operation
- enables and disables individual units or the entire card under software control

- provides outpulsing on the card. Make break ratios are defined in software and downloaded during power up and by software commands.
- provides indication of card status from self-test diagnostics on the LED
- allows trunk type to be configured on a per unit basis in software
- provides 600 ohms termination for 2 and 4-wire E&M trunk circuits
- provides flexible transmission for old/new loss plans
- provides paging (PAG), recorded announcement (RAN), and Music (MUS) interfaces.

Physical description

Switch settings

There are no option switches on the NT5K83GA E&M Tie trunk card. All settings are configured in software.

Connections

The NT5K83GA E&M Tie trunk card has four units. Each unit connects to the shelf backplane through an 80-pin connector. The backplane is cabled to the input/output (I/O) panel which is then cabled to the cross-connect terminal.

At the cross-connect terminal, each unit connects to external apparatus by tip and ring leads.

Hardware installation

Tables 1 to 3-provide cross connect information for the NT5K83GA E&M trunk card.

Table 13
NT5K83GA E&M 2-wire Type 1 and type 5(BPO) Trunk connections

Lead	Pins	Pair color	Unit number
T0 R0	27 2	W-O O-W	Unit
E M	28 3	W-G G-W	0
T1 R1	31 6	R-BL BL-R	Unit
E M	32 7	R-O O-R	1
T2 R2	35 10	R-S S-R	Unit
E M	36 11	BK-BL BL-BK	2
T3 R3	39 14	BK-BR BR-BK	Unit
E M	40 15	BK-S S-BK	3

Table 14
NT5K83GA E&M 2-wire Type 2 Trunk connections

Lead	Pins	Pair color	Unit number
T0 R0	27 2	W-O O-W	
E1 E2	28 3	W-G G-W	Unit 0
M1 M2	29 4	W-G G-W	
T1 R1	31 6	R-BL BL-R	
E1 E2	32 7	R-O O-R	Unit 1
M1 M2	33 8	R-G G-R	
T2 R2	35 10	R-S S-R	
E1 E2	36 11	BK-BL BL-BK	Unit 2
M1 M2	37 12	BK-O O-BK	
T3 R3	39 14	BK-BR BR-BK	
E1 E2	40 15	BK-S S-BK	Unit 3
M1 M2	41 16	Y-BL BL-Y	

Table 15
NT5K83GA E&M 2-Wire Paging trunk connections

Lead designations	Pins	Pair color	Unit number
T0 R0	27 2	W-O O-W	Unit
SIG B SIGA	29 4	W-BR BR-W	0
T1 R1	31 6	R-BL BL-R	Unit
SIG B SIGA	33 8	R-G G-R	1
T2 R2	35 10	R-S S-R	Unit
SIG B SIGA	37 12	BK-O O-BK	2
T3 R3	39 14	BK-BR BR-BK	Unit
SIG B SIGA	41 16	Y-BL BL-Y	3

Table 16
NT5K83GA E&M 2-wire Recorded Announcement trunk connections

Lead designations	Pins	Pair color	Unit number
T0 R0	26 1	W-BL BL-W	Unit
SIG B SIG A	29 4	W-BR BR-W	0
T1 R1	30 5	W-S S-W	Unit
SIG B SIG A	33 8	R-G G-R	1
T2 R2	34 9	R-BR BR-R	Unit
SIG B SIG A	37 12	BK-O O-BK	2
T3 R3	38 13	BK-G G-BK	Unit
SIG B SIG A	41 16	Y-BL BL-Y	3

Table 17
NT5K83GA E&M 2-wire Music trunk connections

Lead designations	Pins	Pair color	Unit number
T0 R0	26 1	W-BL BL-W	Unit 0
T1 R1	30 5	W-S S-W	Unit 1
T2 R2	34 9	R-BR BR-R	Unit 2
T3 R3	38 13	BK-G G-BK	Unit 3

Table 18
NT5K83GA E&M 4-Wire Type 1 and Type 5(BPO) connections

Lead designations	Pins	Pair color	Unit number
RA RB	26 1	W-BL BL-W	Unit 0
TA TB	27 2	W-O O-W	
E M	28 3	W-G G-W	
RA RB	30 5	W-S S-W	Unit 1
TA TB	31 6	R-BL BL-R	
E M	32 7	R-O O-R	
RA RB	34 9	R-BR BR-R	Unit 2
TA TB	35 10	R-S S-R	
E M	36 11	BK-BL BL-BK	
RA RB	38 13	BK-G G-BK	Unit 3
TA TB	39 14	BK-BR BR-BK	
E M	40 15	BK-S S-BK	

Table 19
NT5K83GA E&M 4-Wire Type 2 trunk connections

Lead designations	Pins	Pair color	Unit number
RA RB	26 1	W-BL BL-W	
TA TB	27 2	W-O O-W	Unit 0
E1/E2 M!/M2	28 / 3 29 / 4	W-G / G-W W-BR / BR-W	
RA RB	30 5	W-S S-W	
TA TB	31 6	R-BL BL-R	Unit 1
E1/E2 M!/M2	32 / 7 33 / 8	R-O / O-R R-G / G-R	
RA RB	34 9	R-BR BR-R	
TA TB	35 10	R-S S-R	Unit 2
E1/E2 M!/M2	36 / 11 37 / 12	BK-BL / BL-BK BK-O / O-BK	
RA RB	38 13	BK-G G-BK	
TA TB	39 14	BK-BR BR-BK	Unit 3
E1/E2 M!/M2	40 / 15 41 / 16	BK-S / S-BK Y-BL / BL-Y	

Trunk configuration

Route Data Block

Each trunk unit on the NT5K83GA E&M trunk card is attached to a route with an associated route data block. The route data block is programmed in overlay 16.

Table 20
LD 16 Route Data Block

Prompt	Response	Comments
REQ	NEW	
TYPE	RDB	Define a new Route Data Block
CUST	0-99	Enter customer number
ROUT	0-511	Enter route number
TKTP	TIE, (RAN), (PAG)	Define trunk type as Tie, (Recorded announcement) or (Paging)
ICOG	IAO	Incoming and Outgoing trunk
ACOD	XX	XX=Trunk route access code

Trunk Data Block

Use overlay 14 to configure each of the trunk units on the NT5K83GA E&M trunk card. Default values are shown in brackets.

Table 21
LD 14 Trunk Data Block

Prompt	Response	Comments
REQ	NEW	Define a new trunk unit
TYPE	TIE, (RAN), (PAG)	Trunk type Tie, (Recorded announcement), (Voice paging)
TN	CC UU	Terminal number of the unit in Option 11 format: CC=card number UU=unit number
XTRK see note 1	XFEM	Type is IPE XFEM
SIGL	EM4	4 wire E&M speech
EMTY	(TY1), (TY2), BPO	Signaling, (Type 1), (Type 2), Type 5
STRI	IMM, (WNK), (DDL) (RT)	Incoming start Immediate, (Wink), (Delayed dial)
STRO see note 2	IMM, (WNK), (DDL) (RT)	Outgoing start immediate, (Wink), (Delayed Dial) (RONTRON)
SUPN	YES, (NO)	Answer and disconnect supervision
CLS	TRC, (NTC)	Attenuation pads in, (out)

Note 1: This prompt is required only for the first unit defined on each NT5K83GA card.

Note 2: **RONTRON** signalling is only available from release 20 software onward.

Self-test

When the NT5K83GA E&M Tie trunk card is installed and power is applied to it, a self-test is performed on the card. The red LED on the NT5K83GA faceplate flashes three times, then remains continuously lit until the card is enabled in software. If the self-test fails, the LED will remain lit after the card is enabled.

Technical description

Power requirements

Table 10 lists the power requirements for the NT5K83GA trunk card.

Table 22
NT5K83GA Power requirements

Voltage	Active Current
+15 V dc	150 ma
- 15V dc	150 ma
+8.5 V dc	35 ma
+ 5 V dc	110 ma
-48 V dc	80 ma

Environmental specifications

Table 11 provides the environmental specifications for the NT5K83GA E&M Tie trunk card.

Table 23
NT5K83GA Environmental specifications

Parameter	Absolute Limit
Operating temperature	**10 to 45 degrees C, ambient**
Operating humidity	**20 to 80% RH (non condensing)**
Storage temperature	**-20 to +60 degrees C**

Transmission parameters

The NT5K83GA E&M trunk card supports the old and new Italian loss plan. Both these loss plans are configured in overlay 97. The new Italian loss plan uses the Static Loss plan download and the old loss plan uses the Dynamic Loss Switching feature. For more information refer to NTP 553-2201-182.

New loss plan

For compliance with the new loss plan an E&M trunk must be configured with the transmission characteristics of a type B, C or D interface. These three types may be configured on the E&M trunk and are described as follows:

- Type D interface is a 4W trunk connection, and is configured by setting CLS = NTC in overlay 14.
- Type B interface is a 2W trunk connection, and is configured by setting CLS = NTC in overlay 14.
- Type C interface is a 2W trunk connection, and is configured by setting CLS = TRC in overlay 14.

The transmission for a B or C interface requires a complex balance impedance, and it is necessary to configure BIMP = 3COM in overlay 14. Also, select static loss table TNUM = 9 in overlay 97. The static loss feature means that the A/D and D/A losses are downloaded when the trunk is enabled. The losses do not vary on a per call basis.

Nominal loss values for the NT5K83GA E&M trunk card are given in Table 12.

Table 24
Loss values for NT5K83GA E&M trunk card

Port Type	Analog-to-Digital	Digital-to-Analog
4-wire type D 2 wire type B 2 wire type C	-3.5 dB -6.0 dB 0.0 dB	+3.5 dB +1.0 dB +7.0 dB
PAG	not applicable	+3.5 dB
RAN/MUS	-3.5 dB	not applicable

Note: The tolerance for the above nominal values is ± 0.5dB.

Old loss plan

This is a dynamic loss plan which means that the A/D and D/A losses are downloaded to the trunk on a per call basis, depending on the port type at which the call is terminated. Select static loss table TNUM = 10, dynamic loss table TNUM = 3, and enable the Dynamic loss switching feature in overlay 97. Set CLS = NTC in overlay 14. In addition, to define a unique Italian loss switching matrix select APAD = 3 in overlay 15.

Nominal loss values for the NT5K83GA 2W/4W E&M trunk card are given in Table 13. The loss values for RAN, MUS and PAG are given in Table 14. There are no pad switching for these ports.

Table 25
Loss values for NT5K83GA E&M trunk card

Old loss plan	Analog-to-Digital	Digital-to-Analog
Pads out	0.0 dB	-3.0 dB
Pads in	+2.0 dB	-1.0 dB

Note: The tolerance for the above nominal values is ± 0.5dB.

Table 26
Loss values for NT5K83GA E&M trunk card

Port Type	Analog-to-Digital	Digital-to-Analog
PAG	not applicable	-3.0 dB
RAN/MUS	0.0 dB	not applicable

Note: The tolerance for the above nominal values is ± 0.5dB.

Trunk types description

Each unit on the NT5K83GA E&M Tie trunk card supports:

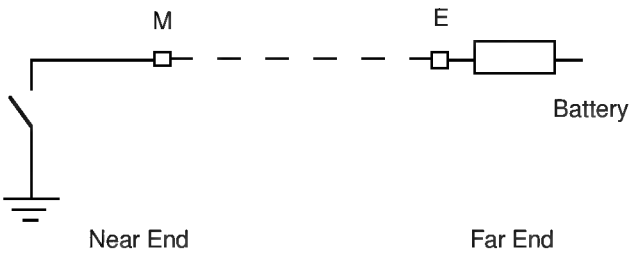
- 4-wire E&M trunk type 5(BPO), type 2 and type 1
- 2-wire E&M trunk type 5(BPO), type 2 and type 1
- Recorded Announcement (RAN) trunk
- Paging (PAG) trunk
- Music (MUS) trunk

For information on features and signaling arrangements, see *Generic X11 Including Supplementary Features* (PO730484).

E&M Type 5(BPO) trunk operation

Type 5 E&M operation uses two signaling leads, E and M, that are electrically separated from the associated speech circuit. Signals are sent on the M lead and received on the E lead as shown in Figure 1.

Figure 2
E&M Type 5 signaling



Send signals

All signals are sent in the form of a contact between M and ground or an open circuit between M and ground.

Receive signals

Signals are received on the E lead by detecting the conditions applied to the M lead by the far end.

Idle state

In the Idle state, the Option 11 receives an idle signal from the far end and is ready to receive calls.

Seize

To place an outgoing call, the Option 11 at the near end sends a seizing signal through the M lead to the far end. The incoming end recognizes the seize signal and prepares to receive digits.

Dialing

Digits are sent through the near end M lead in the form of 10 pps pulses of the open-circuit condition.

Answer

When the called party answers, the far end sends an "answer" signal through the M lead.

Call disconnect

Either party can disconnect the call by applying a clear signal to the M lead. The far end applies a "clear back" signal, while the near end applies a "clear forward" signal. The circuit remains busy until both clear forward and clear backward signals have been exchanged.

Table 15 provides a summary of NT5K83GA Type 5 signaling states.

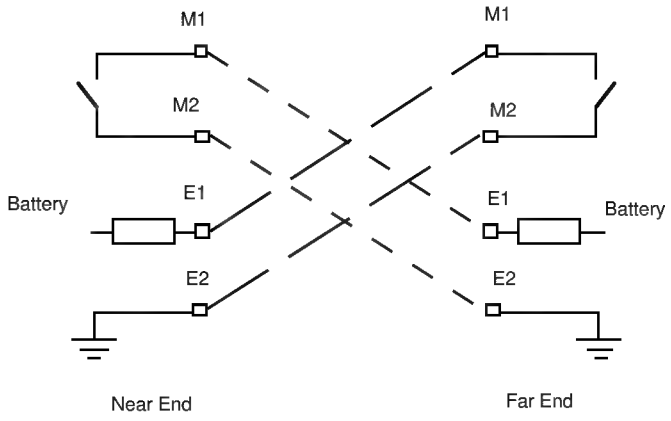
Table 27
Summary of NT5K83GA Type 5 signaling states

Signal	Outgoing PBX sending condition — M lead	Incoming PBX sending condition — M lead
Idle	Earth Off	Earth Off
Seize	Earth On	—
Digit Pulse	Earth Off pulses in step with dial pulses	—
Answer	—	Earth On
Clear forward	Earth Off for longer than 300ms	—
Clear back	—	Earth Off for longer than 300ms

E&M Type 2 trunk operation

Type 2 E&M operation uses two signaling pairs, E and M, that are electrically separated from the associated speech circuit. Signals are sent on the M pair and received on the E pair as shown in Figure 2.

Figure 3
E&M Type 2 signaling



Send signals

All signals are sent in the form of a contact make or break between the two M leads. In the make state there is a maximum of 200 V√Ω between the two M leads. In the break state there is a minimum of 100 kΩ between the M leads.

Receive signals

Signals are received on the E lead by detecting the contact make or break applied at the far-end on the M leads.

Idle state

In the Idle state the Option 11 applies an "Idle Signal" to the M leads to indicate that it is available to receive calls.

Seize

To place an outgoing call, the Option 11 at the near end sends a seizing signal through the M leads to the far end. The incoming end (far end) recognizes the seize signal, busies the circuit against outgoing calls, and prepares to receive digits.

Dialing

Digits are sent through the near end M leads in the form of 10 pps pulses of the open-circuit condition.

Answer

When the called party answers, the far end sends an "answer" signal through the M leads.

Call disconnect

Either party can disconnect the call by applying a clear signal to the M leads. The far end applies a "clear back" signal, while the near end applies a "clear forward" signal. The circuit remains busy until both clear forward and clear backward signals have been exchanged.

Table 16 provides a summary of NT5K83GA Type 2 signaling states.

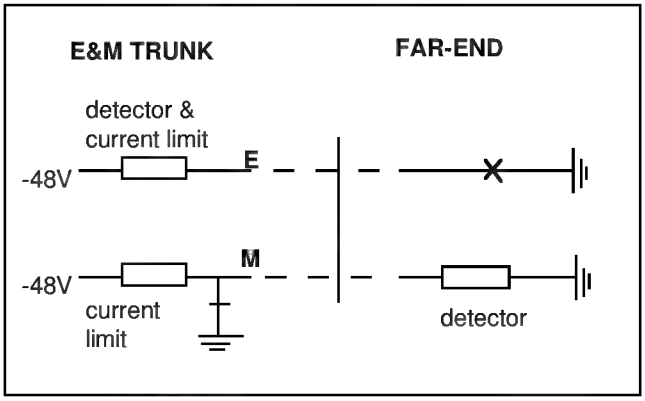
Table 28
Summary of NT5K83GA Type 2 signaling states

Signal	Outgoing PBX sending condition — M Leads	Incoming PBX sending condition — M Leads
Idle	Contact Break	Contact Break
Seize	Contact Make	—
Digit Pulse	Contact Break pulses in step with dial pulses	—
Answer	—	Contact Make
Clear forward	Contact Break for longer than 300ms	—
Clear back	—	Contact Break for longer than 300ms

E&M Type 1 trunk operation

Type E&M operation uses a single signaling pair, E and M, that are electrically separated from the associated speech circuit. Signals are sent on the M lead and received on the E lead as shown in Figure 3. Note that type 1 signaling does not work for a back to back connection.

Figure 4
E&M Type 1 signaling



Send signals

Signals shall be sent on the M wire as either a connection to ground or battery

Receive signals

Signals are received on the E lead by detecting the conditions applied to the M lead by the far end.

Idle state

In the Idle state, the M lead receives an "idle signal" from the Option 11 and is ready to receive calls.

Seize

To place an outgoing call, the Option 11 at the near end sends a seizing signal through the M lead to the far end. The incoming end recognizes the seize signal and prepares to receive digits.

Dialing

Digits are sent through the near end M lead in the form of 10 pps pulses of the open-circuit condition.

Answer

When the called party answers, the far end sends an "answer" signal through the M lead.

Call disconnect

Either party can disconnect the call by applying a clear signal to the M lead. The far end applies a "clear back" signal, while the near end applies a "clear forward" signal. The circuit remains busy until both clear forward and clear backward signals have been exchanged.

Table 29
Summary of NT5K83GA Type 1 signaling states

Signal	Outgoing PBX sending condition — M Leads	Incoming PBX sending condition — M Leads
Idle	Gnd	Open Circuit
Seize	Battery	Gnd
Digit Pulse	Gnd pulses in step with dial pulses	—
Answer	—	Gnd
Clear forward	Gnd for longer than 300 ms	—
Clear back	—	Open Circuit for longer than 300 ms

RONTRON Signalling

RONTRON signalling is an option that can be configured on all types of E&M trunks in Italy (2W type 1, 2, 5 and 4W types 1, 2, 5). With RONTRON enabled the answer signal is not provided by the incoming PBX. Instead the incoming PBX sends a seize acknowledge signal as soon as it receives an incoming seize. This feature is only available on release 20 software onwards.

Recorded Announcement/Music trunk operation

When used in the Recorded Announcement/Music mode, the trunk circuit is connected to a customer provided recorded announcement machine or a music source.

Machines supported

The NT5K83GA E&M Tie trunk card supports the following types of announcement machines:

- Start mode announcement machines
- Continuous mode announcement machines.

Recorded announcers supported include the Cook Digital 4-channel announcer and the Audichron HQI-112.

Start mode

In start mode, the E&M Tie trunk card provides a startpulse to the announcement machine to begin playback of the message. The announcement source requires the following:

- an impedance of 4 ohms or less
- ground to the trunk unit when playing and an open circuit when idle. This is done through a control lead to the trunk circuit.

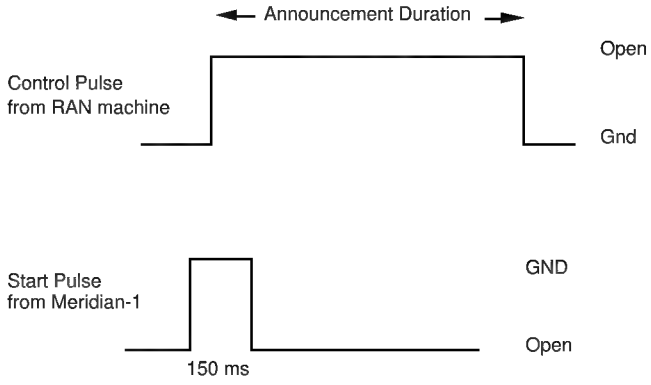
default signal level of -9 dBm (in 600Ω) adjustable to a level of 10 dBm.

To start the announcement, the NT5K83GA E&M Tie trunk card provides a momentary ground signal (150 ms) to the source. The announcement machine should then start playing its message.

The NT5K83GA trunk card expects status information from the announcement machine, that is, whether it is idle or playing. For this reason, the announcement machine requires a control lead to the trunk circuit. In the start mode the input impedance of the Audio Interface is nominally 1200 ohms.

Figure 4 shows recorded announcement in start mode.

Figure 5
Recorded announcement - start mode



Continuous mode

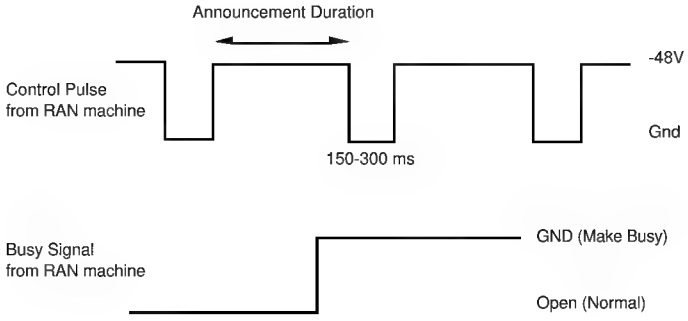
The requirements for continuous mode announcement machines are as follows:

- an impedance of 4 ohms or less
- generation of a control pulse (150 - 300 ms) at the start of the announcement period
- default signal level of -9 dBm (in 600Ω) adjustable to a level of 10 dBm.

The announcement machine may provide a separate busy signal when the machine is recording or erasing a message or if the machine is malfunctioning. The busy signal will be used by the Option 11 for maintenance purposes. In the continuos mode the input impedance of the Audio Interface is nominally 1200 ohms.

Figure 5 shows recorded announcement in continuous mode.

Figure 6
Recorded announcement - continuous mode



Music source

The music source should provide an impedance of 600 Ω. The default signaling level should be -9 dBm (in 600Ω) adjustable to a level of 10 dBm.

Paging trunk operation

When used in the paging mode, the trunk circuit is connected to a customer-provided paging amplifier system. When accessed, the card provides a loop closure. In a typical application, the loop closure will cut off a music supply and switch the paging trunk transmission path to the paging amplifier.

Direct Inward Dial / TIE trunk card

Functional description

The NTCK22AA Direct Inward Dial (DID)/TIE trunk card provides the interface between the Option 11 system and up to eight analog DID trunk lines. It can be installed in slots 1-10 in the main cabinet and in any slot in the expansion cabinet.

Common features

Each NTCK22AA trunk card:

- converts transmission signals from analog-to-digital and from digital-to-analog for up to 8 audio paths
- supports the new Italian loss plan
- supports 2 wire loop dial repeating for tie trunk application
- provides Software selectable A/u law companding
- provides faceplate LED for board status and self- test pass
- disabling of individual units or the entire board
- provides software selectable transhybrid balance impedance to match 600 ohm/Italian complex impedance.
- provides the correct signaling impedance and voltages to operate with the Italian central office
- Full transmission compliance to current Italian technical requirements.

Microprocessor

The NTCK22AA DID/TIE trunk card is equipped with an Intel 87C52 microprocessor that controls card operation and provides the communication function for the card. It contains 8k of EPROM and 256 bytes of RAM.

Signalling and control

The signaling and control portion of the NTCK22AA DID/TIE trunk card operates with the Central Processing Unit (CPU) to control card hardware. The card receives messages from the CPU over a signaling channel and returns status information to the CPU over the same channel. The signaling and control portion of the card provides the means for analog loop termination's to establish, supervise, and take-down call connections.

Signalling interface

Trunk signaling messages are three bytes in length. The messages are transmitted in channel zero of the DS-30X in A10 format.

Configuration information for the NTCK22AA DID/TIE trunk card is downloaded automatically from the CPU during power-up or manually by commands from maintenance programs.

Physical description

Measurements

Each NTCK22AA DID/TIE trunk card measures as follows:

Height:	318 mm (12.5 in.)
Depth:	254 mm (10 in.)

Connections

The NTCK22AA DID/TIE trunk card has eight units. Each trunk unit on the card connects to the backplane through an 80-pin connector. The backplane is cabled to the input/output (I/O) panel, and the I/O panel is cabled to the cross-connect terminal. At the cross-connect terminal, each unit connects to external apparatus by tip and ring leads.

Hardware installation

Table 1 provides cross connect information for the NTCK22AA DID Trunk card.

Table 30
NTCK22AA DID/TIE Trunk connections

Lead	Pins	Pair color	Unit number
T0 R0	26 1	W-BL BL-W	Unit
	27 2	W-O O-W	0
T1 R1	28 3	W-G G-W	Unit
	29 4	W-BR BR-W	1
T2 R2	30 5	W-S S-W	Unit
	31 6	R-BL BL-R	2
T3 R3	32 7	R-O O-R	Unit
	33 8	R-G G-R	3
T4 R4	34 9	R-BR BR-R	Unit
	35 10	R-S S-R	4
T5 R5	36 11	BK-BL BL-BK	Unit
	37 12	BK-O O-BK	5
T6 R6	38 13	BK-G G-BK	Unit
	39 14	BK-BR BR-BK	6
T7 R7	40 15	BK-S S-BK	Unit
	41 16	Y-BL BL-Y	7

Trunk configuration

Route Data Block

Each trunk unit on the NTCK22AA DID/TIE card is attached to a route with an associated route data block. The route data block is programmed in LD 16.

The DID route data block layout is shown in Table 2

Table 31
LD 16 Route Data Block

Prompt	Response	Comments
REQ	NEW	
TYPE	RDB	Define a new Route Data Block
CUST	0-99	Enter customer number
ROUT	0-511	Enter route number
TKTP	DID	Trunk type is Direct Inward Dial
ICOG	ICT	Incoming only trunk
ACOD	XX	XX=trunk route access code
CNTL	YES	Change controls or timers
TIMR	ICF 0	Set Incoming Flash timer to 0 ms
PRDI see note	YES, (NO)	Partial dial timeout required, (Disabled)
EOS	YES	Send End of Selection (number received) signal

Note: If no partial dial time out is required, default at this prompt.

Trunk Data Block

Use overlay 14 to configure each of the trunk units on the NTCK22AA DID trunk card. Default values are shown in brackets.

The DID trunk data block layout is shown in Table 3.

Table 32
LD 14 Trunk Data Block

Prompt	Response	Comments
REQ	NEW	Define a new trunk unit
TYPE	DID	Direct Inward Dial
TN	LL SS CC UU	Terminal Number of the unit: Loop, Shelf, Card, Unit
XTRK (see note)	XDID	Type is IPE DID
SIGL	EAM	E&M signaling
BIMP	600/3COM	Terminal Balance Selection
STRI	IMM	Immediate
STRO	IMM	
SUPN	YES	Answer and disconnect supervision required
CLS	SHL, (LOL) DTN, (DIP)	Attenuation pads in, (out) Digitone dialing, (Digipulse)

Note: This prompt is required only for the first unit defined on each NTCK22AA card.

Self-test

When the card is installed, the red Light Emitting Diode (LED) on the faceplate flashes as the self-test runs. If the self-test completes successfully, the card is automatically enabled (if it has been configured in software) and the LED goes out. If the self-test fails, the LED will remain lit.

Technical description

The technical details of the NTCK22AA DID/TIE trunk card are outlined below.

Power requirements

Table 4 lists the power requirements for the NTCK22AA DID/TIE trunk card.

Table 33
NTCK22AA power requirements

Voltage	Idle current	Active current
+15 V dc	90 ma	200 ma
-15 V dc	105 ma	215 ma
+8.5 V dc	100 ma	100 ma
-48 V dc	50 ma	550 ma
+ 5 V dc	200 ma	200 ma

Environmental specifications

Table 5 lists the environmental specifications for the NTCK22AA DID/TIE card.

Table 34
NTCK22AA Environmental specifications

Parameter	Specifications
Operating temperature	0 to 50 degrees C, ambient
Operating humidity	10 to 95 % RH (non-condensing)
Storage temperature	- 45 to + 70 degrees C
Storage humidity	0 to 95% Relative Humidity

Transmission parameters

The NTCK22AA DID/TIE card can be configured in software to supports the old and new Italian loss plan. In overlay 97 the old loss plan is configured using the Dynamic Loss Switching feature, and the new loss plan is configured using the Static Loss feature.

New loss plan

For compliance with the new loss plan the DID/TIE trunk must be configured with the transmission characteristics of type B or type C interface. These types may be configured on the DID/TIE trunk and are described as follows:

- Type B interface is a 2W trunk connection, and is configured by setting CLS = NTC in overlay 14.
- Type C interface is a 2W trunk connection, and is configured by setting CLS = TRC in overlay 14.

The transmission for a B or C interface requires a complex balance impedance, and it is necessary to configure BIMP = 3COM in overlay 14. Also, select static loss table TNUM = 9 in overlay 97. The static loss feature means that the A/D and D/A losses are downloaded when the trunk is enabled. The losses do not vary on a per call basis.

The new loss plan for the NTCK22AA DID/TIE card is given in Table 6.

Table 35
NTCK22AA Loss values

New loss plan	Analog-to-Digital	Digital-to-Analog
DID type B	-6.0 dB	+1.0 dB
LDR (TIE) type B	-6.0 dB	+1.0 dB
LDR (TIE) type C	0.0 dB	+7.0 dB

Note: The tolerance for the above nominal values is ±0.5dB.

Old loss plan

This is a dynamic loss plan which means that the A/D and D/A losses are downloaded to the trunk on a per call basis, depending on the port type at which the call is terminated.. Select static loss table TNUM = 10, dynamic loss table TNUM =3, and enable the dynamic loss switching feature in overlay 97. Set APAD = 3 in overlay 15. In addition set CLS = NTC for TIE and CLS = SHL for DID in overlay 14. With the dynamic loss feature, pads are switched in or out on the trunk depending on the terminating port type.

The old loss plan for the NTCK22AA DID/TIE card is given in Table 7.

Table 36
NTCK22AA Loss values

Old loss plan	Analog-to-Digital	Digital-to-Analog
Pads Out	0.0 dB	-3.0 dB
Pads In	+2.0 dB	-1.0 dB

Note: The tolerance for the above nominal values is ±0.5dB.

Direct Inward Dial description

Each unit on the NTCK22AA card is capable of operating as a DID trunk. Table 4-8 presents a summary of NTCK22AA DID trunk card signaling states. The A wire corresponds to the Ring lead and the B wire the Tip.

Idle State

When the Central Office presents a high impedance to the DID unit, the NTCK22 trunk card is in the idle state. Negative battery (-48V) is present on the A wire, and ground is present on the B wire. Loop current expected is less than 10ma.

Seize

The Central Office initiates a call by reversing Battery and Ground (-48v on B, Ground on A). Also, a low impedance loop is placed across the A and B wires causing an increase in current flow. At the OPT 11 a message is sent to the Central Processing Unit (CPU), and the microprocessor prepares to receive dialing digits.

Dialing

The Central Office sends digits in the form of make and break signals. Loop current expected is greater than 24ma and the speech path is off. The signaling will have the following characteristics:

Break/make ratio 1.4 to 1.7
Break+make duration 90-110ms
Interdigit pause >700ms
Pulses <15ms shall be ignored
Pulses >25ms shall be Validated

Answer

When the terminating party answers, the DID unit reverses battery and ground on the A and B leads (-48V on B and Ground on A).

Far End Release

The Central Office disconnects the call by sending a forward release signal to the OPT 11. The forward clear signal is a high impedance, direct battery in the direction of the DID unit.

When the DID unit detects the high impedance loop, it sends a change of state message to the CPU. The OPT 11 will send a forward release acknowledgment message to the CO, and the DID will revert to low impedance and return to the idle state.

Near End Release

When the Meridian 1 disconnects the call, the CPU sends a message to the DID unit, which in turn will send a backward release signal to the CO.

When the Central Office detects the release signal it restores a high impedance loop towards the OPT 11. The CPU interprets the high impedance loop as a release acknowledgment signal from the CO and the DID will revert to the idle state.

Backward Busy or Disabled

When a DID unit is busy or disabled and cannot accept a call, it sends a disabled signal to the public exchange. In this state, both battery and ground are removed from the A and B wires.

Table 37
Summary of NTCK22AA DID Trunk card signaling states

Signal	Central Office State	Meridian 1 State
Idle	High Impedance, Direct Battery	Low Impedance
Seize	Low Impedance, Reverse Battery	Low Impedance
Dialing	Open Circuit, Reverse Battery	Low Impedance
End of Selection	Low Impedance, Reverse Battery	High Impedance
Answer	Low Impedance, Reverse Battery	Low Impedance
Central Office disconnects first (Far End Release)	High Impedance, Direct Battery	Open Circuit
Far End Release acknowledgment	High Impedance, Direct Battery	Low Impedance
Meridian 1 disconnects first (Near End Release)	Low Impedance, Reverse Battery	High Impedance
Near End Release acknowledgment	High Impedance, Direct Battery	Low Impedance
Disabled or Barred	—	Open Circuit

Loop Dial Repeating Tie Trunk

Each unit on the NTCK22AA DID/TIE card is capable of operating as a LDR TIE trunk. Table 4-11 presents a summary of NTCK22AA LDR trunk unit signaling states. Refer to NTP 553-2201-186 "Loop Signaling Trunk Engineering Description", for details of the LDR TIE Trunk protocol

Software Release

TIE trunk functionality on the NTCK22AA is supported from release 20 software onward.

Route Data Block

Each trunk unit on the NTCK22AA DID/TIE card is attached to a route with an associated route data block. The route data block is programmed in LD 16.

The TIE route data block layout is shown in Table 9.

Table 38
LD 16 Route Data Block

Prompt	Response	Comments
REQ	NEW	
TYPE	RDB	Define a new Route Data Block
CUST	0-99	Enter customer number
ROUT	0-511	Enter route number
TKTP	TIF	Trunk type is LDR
ICOG	IAO	TIE trunk
ACOD	XX	XX=trunk route access code
CNTL	YES	Change controls or timers
TIMR	EOD 7000	Set End of Dial timer to 6912 ms

Trunk Data Block

Use overlay 14 to configure each of the trunk units on the NTCK22AA DID/TIE trunk card. Default values are shown in brackets.

The TIE trunk data block layout is shown in Table 10.

Table 39
LD 14 Trunk Data Block

Prompt	Response	Comments
REQ	NEW	Define a new trunk unit
TYPE	TIE	Tie Trunk
TN	LSCU	Terminal Number of the unit: Loop, Shelf, Card, Unit
XTRK (see note)	XDID	Type is IPE DID
SIGL	LDR	Loop dial repeat signaling
LDOP	LOOP/(BOP	LOOP/Battery dialing
BIMP	600/(3COM)	Terminal Balance impedance
STRI	IMM	Immediate start
STRO	IMM	
SUPN	YES	Answer supervision equipped
CLS	NIC TRC DIP, (DTN)	LDR Type B Trunk LDR Type C Trunk Digipulse/Digitone dialing

Note: This prompt is required only for the first unit defined on each NTCK22AA card.

Outgoing Call

When the Station or attendant dials the trunk access code, software sends a message to initiate the outgoing seize. The LDR trunk seizes the line by removing the battery feed and placing a low resistance loop between Tip and Ring. Address signaling is applied from the Opt 11 in the form of DTMF, Loop Break or Battery/Ground Pulsing.

In loop break pulsing, the trunk pulses low impedance for the make period and open circuit for the break period. In battery pulsing, the trunk pulses reverse battery (-48V on Tip, Gnd on Ring) for the make period, and open circuit for the break period.

If answer supervision is provided by the far end, reverse battery will be applied when the called party answers. This is detected and monitored at the near end. If Answer supervision is not equipped at the far end , then the near end will not know if the call has been answered and also, the far end cannot release the call.

Near End Release

If the LDR has received an answer signal from the far end then the near end must break the loop and monitor for a polarity reversal indicating that the far end has returned to the idle state. The near end then reverts to idle by applying ground to Tip and battery to Ring.

If the LDR has not previously received an answer signal from the far end it may revert to idle by applying equal polarity battery to both sides of the loop, but it will not receive a change of state signal from the far end. The Outgoing Guard Timer will ensure that sufficient time is allowed for the far end to revert to idle before a new call is attempted.

Far End Release

The far end can initiate a clear down if it has provided an answer signal. It does this by reverting to an idle state polarity. The near end reports this to software which starts the Outgoing Flash (OGF) timer. Once this expires, the near end reverts to its idle condition.

Incoming Call

The far end initiates a call by placing a low resistance loop between Tip and Ring. Battery current flows from the near end bridge and the incoming seize is reported to software in the Opt 11. Address signaling is applied from the far end in the form of Loop Pulsing, Battery Pulsing or DTMF.

When the called party answers, if class-of-service = Ans Supn, software sends a message to the trunk which reverses battery feed polarity to the line. when the called party answers. If class-of-service = No Ans Supn, then no signal is sent when the near end party answers.

Near end release

The near end can only initiate a clear down if it has provided an answer signal. It does this by reverting to an idle state polarity. Also, there is a partial release from software and the Disconnect Supervision (DSI) timer is started. The far end detects and times this against its own flash timer, before reverting to the idle condition.

Far end release

The far end initiates a clear down by removing its low resistance loop. This is reported to software which starts the Incoming Flash(ICF) timer. When the flash timer expires an idle message is sent to the trunk which reverts to its idle state.

Table 40
Summary of NTCK22AA LDR Trunk card signaling states

Signal	Originating End	Terminating End
Idle	Direct Battery	Direct Battery
Seize	Low Impedance	Direct Battery
Dialing	Low Impedance, Open Circuit	Direct Battery
Battery Dialing	Reverse Battery, Open Circuit	Direct Battery
Answer	Low Impedance	Reverse Battery, Supn
Orig. Disconnects first (Forward Release)	Open Circuit	Reverse Battery
Forward Release acknowledgment	Direct Battery	Direct Battery
Term disconnects first (Backward Release)	Low Impedance	Direct Battery
Backward Release acknowledgment	Direct Battery	Direct Battery
Disabled or Barred	—	Open Circuit

~~NT5K02JA~~ Flexible analog line circuit card

Functional description

The Flexible analog line card provides an interface for up to 16 analog (500/2500-type) telephones lines. It can be installed in any PE slot that supports Intelligent Peripheral Equipment (IPE).

There are two types of Flexible Analog Line Cards for use in Italy:

- the NT5K02TA line card with message waiting
- the NT5K96TA line card without message waiting.

Common features

Both Flexible Analog line cards provide the following features:

- analog to digital and digital to analog conversion for 16 analog telephone lines
- software selectable A-Law or μ-Law companding
- hookswitch flash detection
- variable loop current to allow automatic gain compensation according to loop length
- card-identification for auto configuration
- additionally, the NT5K02TA circuit card provides a flashing low voltage 1 Hz message waiting signal.

Physical description

Switch settings

There are no option switches on the Flexible Analog line card. All settings are configured in software.

Connections

The Flexible Analog line card has 16 units. Each unit connects to the shelf backplane through an 80-pin connector. The backplane is cabled to the input/output (I/O) panel which is then cabled to the cross-connect terminal.

At the cross-connect terminal, each unit connects to external apparatus by tip and ring leads. For detailed termination and cross-connect information, see the *System installation procedures* (553-3001-210).

Faceplate LED

The faceplate of the NT5K02 is equipped with a red LED which lights when all the assigned units on the circuit card are disabled.

Technical description

Power requirements

Table 1 lists the power requirements for the NT5K02 Flexible Analog line card.

Table 41
NT5K02 Flexible Analog line card power requirements

Voltage	Idle current	Active current
+15.0 V dc	120 ma	120 ma
-15.0 V dc	24 ma	24 ma
+ 8.5 V dc	250 ma	280 ma
-48.0 V	0 ma	320 ma
- 48.0 V dc	60 ma	700 ma
Ring V ac	0 ma	160 ma (Note)

Note: Reflects 10 ma for ringing one telephone per unit. There may be more than one telephone or ringer on a unit.

Environmental specifications

Table 2 lists the environmental specifications of the Flexible Analog line card.

Table 42
NT5K02 Flexible Analog line card environmental specifications

Parameter	Specifications
Operating temperature	0 to 45 degrees C, ambient
Operating humidity	5 to 95 % Relative Humidity
Storage temperature	- 40 to + 70 degrees C

Signalling

Loop operation

The Flexible Analog Line Card is loop start, with a loop limit of 1800 Ω including the telephone set.

Table 3 lists the number of telephone sets that can be supported by the loop.

Table 43
Loop limits

Loop resistance including telephone sets	Number of telephone sets
350 Ω or less	2
Over 350 Ω to a maximum of 1800 Ω	1

Ringers

The Flexible Analog Line Card supports any number of ringers up to a maximum ac impedance presented to the line of 3.5 KΩ. Typically, a maximum of two NE-C4A-type ringers can be supported.

Message waiting indicator

The message waiting indicator consists of a LED flashing at a rate of 1 Hz at the telephone set. (A continuously lit LED as a message indicator is not provided.) The LED is activated as a result of a reversal of the Tip and Ring leads.

Transmission parameters

Refer to Northern Telecom Publication (NTP) 553-2201-182 *Summary of transmission parameters* for a complete description of transmission characteristics for Intelligent Peripheral Equipment (IPE).

Tables 4 indicates the loss values for the flexible analog line card.

Table 44
Loss values for NT5K02TA Flexible Analog line card

New loss plan	Analog-to-Digital	Digital-to-Analog
XFALC Type C1	0.0 dB	+7.0 dB

Old loss plan	Analog-to-Digital	Digital-to-Analog
XFALC	+4.0 dB	+1.0 dB

Tone detector circuit card

Functional description

The NT5K48 Tone Detector circuit card provides tone detection, for either Dual Tone Multifrequency (DTMF) or Dial Tone (DT) detection. It can be installed in any PE slot that supports Intelligent Peripheral Equipment (IPE).

Common features

The NT5K48 Tone Detector circuit card:

- provides eight channels of tone detection configurable on a call-connection basis for either DTMF or DT detection
- is configurable on a call connection basis to provide both first stage Dial Tone Detection (DTD) and second stage DTD

Note: The NT5K48 Tone Detector remains dedicated to the call while the connecting process is progressing. Once the call is connected, the NT5K48 Tone Detector is released: it will not detect dial tone after the call is established.

- supports both A-Law and μ-Law companding
- provides card-identification for auto configuration, and for determining the serial number and firmware level of the card
- provides for hardware self test
- allows country specific DTMF and dial tone characteristics to be downloaded from software.

Physical description

Measurements

The NT5K48AA Tone Detector circuit card measures 12.5 in. (320 mm) in height by 10 in. (255 mm) in depth.

Switch settings

There are no option switches on the NT5K48 Tone Detector circuit card. All settings are configured in software.

Self-test

When the NT5K48 Tone Detector circuit card is installed and power is applied to it, a self-test is performed on the card. The red LED on the NT5K48 faceplate flashes three times, then remains continuously lit until the card is enabled in software. If the self-test fails, the LED will remain lit after the card is enabled.

Technical description

The technical details of the NT5K48AA Tone Detector circuit card are outlined below.

Power requirements

The NT5K48 Tone Detector has a maximum current draw of 1.5 amps at 5V.

Environmental specifications

Table 1 lists the environmental specifications of the NT5K48 Tone Detector circuit card .

Table 45
NT5K48 circuit card environmental specifications

Parameter	Specifications
Operating temperature	0 to 45 degrees C, ambient
Operating humidity	5 to 95 % Relative Humidity
Storage temperature	- 40 to + 70 degrees C

Dial tone detection

The NT5K48AA Tone Detector circuit card is designed for use in Italy

First stage dial tone detection

The following dial tone characteristics are supported by the NT5K48AA Tone Detector circuit card used in Italy.

- First stage dial tone frequency detection band (DFQ)
  - Band 4355 Hz through 550 Hz
- Minimum Detect Level (MDL)
  - -10 dBmO through -40 dBmO in decrements of 2 dB
- Minimum Validation Time (MVT)
  - duration of 100 ms through 1600 ms in increments of 100 ms
- Break duration of continuous tone not cadenced (BRK)
  - 0 ms through 240 ms in increments of 16 ms
- Cadence type (CAD)
  - 0 (continuous tone)

Second stage dial tone detection

Second stage dial tone detection allows the NT5K48AA Tone Detector to interrupt digit outpulsing until a second dial tone is detected. The characteristics of the tone detected are as defined for the first stage dial tone.

Note: Second stage dial tone is not usually used in Italy.

Country specific tone detection

The NT5K48AA Tone Detector is designed for use in Italy It can be set to the characteristics of country specific tones by using overlay 97.

Typical settings for Italy are as follows:

Characteristic	Mnemonic	Setting
Frequency Band	DFQ	4
Minimum Detect Level	MDL	-28 dBm
Minimum Validation Time	MVT	600 ms
Break Tolerance	BRK	000 ms
Cadence Type	CAD	00
Minimum Acceptance Level	MINL	-30 dBm

Refer to the *X11 Input/Output Guide* 553-3001-400 for more detailed information about use of overlay programs.

Meridian 1

Intelligent peripheral equipment circuit cards for Italy

Option 11 - Description and Installation

© 1994 Northern Telecom
All rights reserved
Information is subject to change without notice. Northern Telecom reserves the right to make changes in design or components as progress in engineering and manufacturing may warrant. This equipment has been tested and found to comply with the limits for a Class A digital device pursuant to Part 15 of the FCC rules.
SL-1 and Meridian 1 are trademarks of Northern Telecom.
Publication number: Supplement to 553-3011-210
Document release: Provisional 1.0
Date: April 1994
Printed in Canada